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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/863,503	05/23/2001	Hiroshi Akita	CSC-029	9374

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EXAMINER	
ALEJANDRO, RAYMOND	
ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 06/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/863,503	AKITA, HIROSHI	
	Examiner	Art Unit	
	Raymond Alejandro	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a) In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *7-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *7-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 04/16/04 has been entered.

This office action is being provided in response to above-mentioned RCE and remarks the following: the applicant has overcome the objections, the 35 USC 112 rejection and the 35 USC 103 rejection. Nevertheless, the present claims are newly rejected over additional art as seen below and for the reasons of record.

Election/Restrictions

2. Applicant's cancellation of claims 1-6 and 13-19 in Paper No. 04/16/04 is acknowledged.

Drawings

3. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 10/31/03 have been accepted. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance. *Please disregard this comment should applicants have already submitted new replacement drawing sheets.*

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 7 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki 5346780 in view of Kejha et al 6326105.

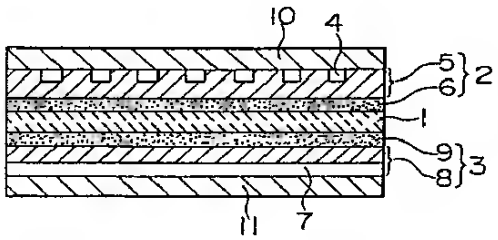
The instant claims are directed to a fuel cell wherein the disclosed inventive concept comprises the specific membrane-equipped composite electrolyte. Other limitations include the liquid electrolyte and monomer unit; the cross-linking agent; and the polymer.

With respect to claim 7:

Suzuki discloses a fuel cell comprising a pair of gas-diffusion electrodes provided with a porous catalyst layer and an acidic electrolyte layer held by the pair of gas-diffusion electrodes (ABSTRACT). **Figure 1** below illustrates a phosphoric acid fuel cell including a cell unit comprising an electrolyte layer 1 which is a porous electrolyte-retaining member such as a

porous substance retaining phosphoric acid (H_3PO_4) as an acidic electrolyte (*the matrix impregnated with phosphoric acid*) (COL 4, lines 56-64). The electrolyte layer is held by a pair of gas-diffusion electrodes i.e. a cathode 2 and an anode 3 (COL 4, lines 56-64). The cathode is composed of a gas feed layer 5 (*it is noted that the gas feed layer serves as the gas diffusion layer*) and a catalyst layer 6. The anode 3 is composed of a gas feed layer 8 (*it is noted that the gas feed layer serves as the gas diffusion layer*) and a catalyst layer 9 (COL 4, lines 64-68). It is also disclosed that the phosphoric acid (H_3PO_4) is in liquid phase (COL 7, lines 62-63).

FIG. 1



Examiner's note: *It is noted that the instant claims are being construed as product-by-process claims and that the product itself does not depend on the process of making it. Accordingly, in a product-by-process claim, the patentability of a product does not depend on its method of production. In that, it is further noted that the product in the instant claims is the same as or obvious over the product of the prior art. Therefore, the specific method limitations (i.e. "wherein said crosslinked polymer membrane is produced in a chemical reaction between a crosslinkable polymer deposited onto the entire surface of the matrix and a crosslinking agent"), does not patentable distinguish the product because what is given patentably consideration is the product itself and not the manner in which the product was made. Therefore, the patentability of a product is independent of how it was made.*

With respect to claim 8 and 11:

Suzuki discloses that the electrolyte is phosphoric acid in liquid phase (COL 4, lines 56-64/ COL 7, lines 62-63).

Suzuki discloses a phosphoric acid fuel cell according to the foregoing. However, Suzuki does not disclose coating the entire surface of the matrix with a crosslinked polymer.

With respect to claims 7 and 10:

Kejha et al disclose polymer electrolyte composites which are formed by coating an inert electrically insulating fiber net (*the matrix*) which includes a polyvinyl alcohol binder, with a liquid polymer which may be ionically conductive, and curing the polymer to form a solid state electrolyte composite (ABSTRACT). In particular, Kejha et al teach that solid or semi-solid state electrolytes can be made by using a composite construction, preferably a net of fibers being coated with a liquid polymer material which is solidified by cross-linking to form a solid state matrix (COL 1, lines 55-65). It is further disclosed that the electrically insulating component of the composite electrolyte can be dip coated, or coated by other means into a polymer electrolyte film (COL 2, lines 30-35). *Thus, given that the electrically insulating component (the matrix) is being dip coated, it is contended that the entire surface of the matrix, hence, is coated with the crosslinked polymer coating.*

Kejha et al discuss that the solid state polymeric electrolyte composition is suitable for fuel cells (COL 3, lines 46-51) and wherein the electrolyte contains PVDF and PEO, or PVD/HFP and PEO, and at least one aprotic liquid and at least one salt (COL 3, lines 46-53). Kejha et al also disclose the use of an impregnated composite (COL 3, lines 60-64). *Thus, Kejha*

et al envision the formation of a composite electrolyte containing a matrix material impregnated with liquid and being entirely coated by a crosslinked polymer and its application in fuel cell.

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to make the electrolyte of Suzuki by coating the entire surface of the matrix with the crosslinked polymer of Kejha et al because Kejha et al disclose that such coated polymeric electrolyte composite is highly ion conductive, have low resistance, is shorting-proof, dendrite-proof, flexible yet mechanically strong, lightweight, and inert to component materials. *Further, Kejha et al envision the formation of a composite electrolyte containing a matrix material impregnated with liquid and being entirely coated by a crosslinked polymer as Kejha et al disclose the use of impregnated composites as well as having the electrolyte composite formed by using a composite electrically insulating material being coated with a liquid polymer material which is solidified by cross-linking. Moreover, it is noted that the two references are pertinent to each other as they both address the same problem of providing suitable electrolyte composite materials for fuel cell applications.*

7. Claims 8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki 5346780 in view of Kejha et al 6326105 as applied to claims 7 and 10 above, and further in view of Savinell et al 5525436.

Suzuki and Kejha et al are applied, argued and incorporated herein for the reasons above. Nevertheless, the foregoing prior art fails to disclose the membrane composed of a basic polymer having a secondary amine monomer.

With respect to claim 8 and 11:

Savinell et al disclose a proton conducting polymer used as membranes, the polymer being basic polymer complexed with a strong acid (ABSTRACT/ COL 2, lines 50-67). Savinell et al teach the use of such membranes in acid fuel cells. Savinell et al discloses the particular use of polybenzimidazole as a suitable polymer electrolyte membrane (ABSTRACT/ COL 2, lines 50-67). It is also disclosed that the polybenzimidazole is doped with a strong acid, such as phosphoric acid or sulfuric acid (COL 2, lines 63-67). Savinell et al disclose that those polymers contemplated for use in his invention which demonstrate solubility in dilute acid may be made more stable by cross-linking in place in the film by any one of a number of known cross-linking techniques (COL 5, lines 45-50). *Thus, the protective membrane or coating is formed by cross-linking the polymer for constructing the matrix.*

Savinell et al discloses the particular use of polybenzimidazole as a suitable polymer electrolyte membrane (ABSTRACT/ COL 2, lines 50-67). *Thus, the membrane is composed of a basic polymer having a structural unit of monomer of secondary amine.* It is also disclosed that the polybenzimidazole is doped with a strong acid, such as phosphoric acid or sulfuric acid (COL 2, lines 63-67).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to make use the membrane composed of a basic polymer having a secondary amine monomer of Savinell et al as the crosslinked polymer membrane in the electrolyte of Suzuki and Kejha et al as Savinell et al teach that polybenzimidazole (a basic polymer having a secondary amine monomer) is of particular interest because it can be doped with a strong acid as well as because these polymers film exhibit excellent oxidative and thermal stability; these properties being further enhanced by the acid nature of the polymer. Further, it has been found

that films comprising polymers containing basic groups that can form complexes with stable acids provide a viable alternative as proton exchange membrane matrix or medium, being polybenzimidazoles an example of a suitable polymer for this purpose. Moreover, these polymers require low water activity, thus avoiding operating temperature limits due to the boiling point of water; and showing capability to operate at elevated temperatures, thereby reducing the potential for anode/cathode poisoning. Further, these polymers do not suffer significantly from methanol cross-over because of low methanol swelling with methanol vapor and high glass transition temperatures. Hence, it provides a solid polymer to be used as an electrolyte matrix which is stable and retains reasonable ionic conductivity and does not suffer from known problems associated with catalyst stability and activity. In addition, it is noted that Savinell et al disclose that those polymers contemplated for use as electrolyte matrix which demonstrate solubility in dilute acid may be made more stable by cross-linking in place in the film by any one of a number of known cross-linking techniques. Accordingly, Savinell et al directly teach the use of cross-linked polymers to enhance stability. Therefore, the protective membrane in the electrolyte matrix is obtained when the polymer acting as the electrolyte matrix is cross-linked as instantly claimed.

8. Claims 9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over the preceding combination of Suzuki 5346780-Kejha et al 6326105 and Savinell et al 5525436 as applied to claims 8 and 11 above, and further in view of the WO 00/44816 publication.

Suzuki'780, Kejha et al'105 and Savinell et al are applied, argued and incorporated herein for the reasons above. However, none of the foregoing references teach the specific cross-linking agent containing two or more isocyanate groups.

With respect to claims 9 and 12:

The WO'816 publication discloses bridged polymers membrane for fuel cells (ABSTRACT) wherein the basic polymer may be polybenzimidazole (PAGE 3, lines 11-12) and the bridging agent (*the cross-linking agent*) has at least two isocynate groups in the molecule thereof (PAGE 3, lines 5-6).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific cross-linking agent containing two or more isocyanate groups of the WO'816 publication to cross-link the polymer electrolyte matrix of Suzuki'780, Kejha et al'105 and Savinell et al because the WO'816 disclose that by bridging the basic polymer using the specified bridging agent in the shaped membrane the mechanical strength of the polymer electrolyte is improved. Thus, by employing the specified cross-linking agent and obtained a cross-linked product as part of the polymer electrolyte membrane, a polymer having a sufficient degree of mechanical strength is achieved, thereby reducing its swelling property when immersed in water or aqueous solution.

Response to Arguments

9. Applicant's arguments, see the RCE filed 04/16/04 for specific details, with respect to the rejection of claims 7-12 have been fully considered and are persuasive. Therefore, the rejection has been overcome. However, upon further consideration, a new ground of rejection is made as

seen above. Accordingly, applicant's arguments with respect to claims 7-12 have been contemplated but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Raymond Alejandro
Examiner
Art Unit 1745